II. PRINCIPLES FOR ADDRESSING SEA-LEVEL RISE IN THE COASTAL ZONE

The following principles are intended to guide sea-level rise adaptation efforts at the Coastal Commission, and many of the principles derive directly from the requirements of the Coastal Act. Each of the four groups of principles below embodies important concepts that are specifically and increasingly raised by the challenges of rising sea levels. This guidance builds on the cumulative knowledge and experience of the Commission to help identify practical guidance for addressing sea-level rise consistent with these principles and the statewide policies of the California Coastal Act.

A. USE SCIENCE TO GUIDE DECISIONS [Coastal Act Sections 30006.5; 30335.5]

1. **Acknowledge and address sea-level rise as necessary in planning and permitting decisions.** Integrate sea-level rise into all appropriate coastal management and decision-making processes, including Local Coastal Programs (LCPs), Port Master Plans (PMPs), Public Works Plans (PWPs), Long Range Development Plans (LRDPs) and other plans, Coastal Development Permits (CDPs), federal consistency decisions, public access dedication efforts, and habitat preservation and restoration. Addressing sea-level rise encompasses current and future sea levels as well as changing risks and coastal conditions associated with sea level. Sea-level rise should be integrated into existing coastal hazard, shoreline change, and extreme event analyses, including any potential changes to flooding, inundation, wave impacts, erosion, sediment supplies, extreme events, and saltwater intrusion. Plans and projects should include a sea-level rise vulnerability and risk assessment and describe any actions needed to minimize risks to coastal resources and development due to sea-level rise, including land use designations, new policies, or increased setbacks or design changes.

2. **Use the best available science to determine locally relevant (context-specific) sea-level rise projections for all stages of planning, project design, and permitting reviews.** The best available science should be used in planning and regulatory actions. With respect to sea level, this means that the best available sea-level rise projections should be used to establish a range of locally-relevant future water levels and shoreline change, and to assess vulnerability and risks from sea-level rise. Simple extrapolation of historic trends should not be used. This science may include peer-reviewed and well-documented climate science, adaptation strategies, and management practices. At the time of this report's publication, the best available science on sea-level rise in California is the 2012 National Research Council (NRC) Report, *Sea-Level Rise for the Coasts of California, Oregon and Washington: Past, Present and Future* (NRC, 2012) (See Table 2). The State of California Sea-Level Rise Guidance Document (March 2013) includes projections that are based on the NRC report and the state guidance document may be updated in the future to reflect significant changes in the best available science.[8] This

[8] Available at http://www.opc.ca.gov/2009/12/climate-change/.

NRC report contains regional sea-level rise projections for North and South of Cape Mendocino.[9] Where local vertical land motion or other conditions vary considerably from the regional average used in the projections (such as vertical land motion trends in parts of Humboldt Bay and the Eel River Estuary), these projections should be modified to account for local conditions.

Table 2. NRC Sea-Level Rise Projections for California (NRC, 2012)

TIME PERIOD	NORTH OF CAPE MENDOCINO[10]	SOUTH OF CAPE MENDOCINO
2000 – 2030	-4 – +23 cm (-1.56 – +9 inches)	4 – 30 cm (1.56 – 11.76 inches)
2000 – 2050	-3 – + 48 cm (-1.2 – +18.84 inches)	12 – 61 cm (4.68 – 24 inches)
2000 – 2100	10 – 143 cm (3.6 – 56.28 inches)	42 – 167 cm (16.56 – 65.76 inches)

The science on sea-level rise is constantly evolving, and some of the processes that are not fully understood (e.g., ice sheet dynamics) could potentially have large effects on future sea-level rise. The Commission will re-examine the best available science at least every 5 years or as needed with the release of new information on sea-level rise.[11] In addition, Commission staff intends to submit a periodic status report to the Commission describing updates on the best available science and adaptation practices, and any potential recommended changes to the guidance document.

3. **Recognize and address scientific uncertainty using scenario planning and adaptive management techniques.** Given the uncertainty in the magnitude of future sea-level rise, projects and plans should use scenario-based analysis to examine the full range of possible shoreline changes and sea-level rise risks. As appropriate, projects, resource management plans, and planning updates should use an adaptive management framework with regular monitoring and reassessments. An adaptive management framework involves learning and dynamic adjustment in order to accommodate uncertainty.

[9] The NRC Committee divided the Pacific coast for California, Oregon and Washington into two regions, north and south of Cape Mendocino, due to differences in tectonics that occur at this point. North of Cape Mendocino, land is rising by 1.5 to 3.0 mm/yr as ocean plates descend below the North American plate at the Cascadia Subduction Zone. South of Cape Mendocino, the coast is sinking at an average rate of about 1 mm/yr, although local rates vary widely (NRC 2012, pg 3). Humboldt Bay has not experienced the regional uplift that characterizes most of the coast north of Cape Mendocino, and instead has shown the highest subsidence recorded for the California coast. As a result, the projections for north of Cape Mendocino may not be appropriate for use in or near Humboldt Bay and the Eel River Estuary.

[10] Since portions of Humboldt Bay are experiencing subsidence, and thus differ from the regional uplift conditions, the projections for north of Cape Mendocino may not be appropriate for use within parts of Humboldt Bay. See Appendix B for additional discussion about vertical land movement and relative sea-level rise.

[11] Major scientific reports include the release of the 2013 National Climate Assessment and the IPCC 5th Assessment Report, which is due for phased releases in 2013-2014.

B. MINIMIZE COASTAL HAZARDS THROUGH PLANNING AND DEVELOPMENT STANDARDS [Coastal Act Sections 30253; 30235; 30001, 30001.5]

4. **Avoid significant coastal hazard risks where feasible.** Section 30253 of the Coastal Act requires new development to minimize risks to life and property in areas of high geologic and flood hazard. The strongest approach for minimizing hazards is to avoid new development within areas vulnerable to flooding, inundation, and erosion. Hazard avoidance also ensures stable site conditions without the need for long-term financial and resource commitments for protective devices. Methods to direct new development away from hazardous locations include changing zoning and land use intensity, establishing conservation easements or open space designations, and siting structures a safe distance away from hazard areas (setbacks). Hazard avoidance efforts should not result in impacts to coastal resources or encroachment into coastal habitats.

5. **Minimize hazard risks to new development over the life of the authorized structures.** In situations where hazards due to sea-level rise cannot be avoided, new development should minimize risks over the life of the structure, without the use of bluff retaining or shoreline protection devices. New structures in hazard areas should include provisions to ensure structures are modified, relocated, or removed when they become threatened by natural hazards, including sea-level rise, in the future. Risk minimization efforts should not result in impacts to coastal resources or encroachment into coastal habitats.

6. **Avoid or minimize coastal resource impacts when addressing risks to existing development**. Existing coastal development should avoid or minimize impacts to coastal resources in any repairs, maintenance or renovations. Sea-level rise protection measures for existing development should be analyzed for coastal resource impacts, and any impacts should be minimized. Renovations or redevelopment that constitutes new development should avoid or minimize risks and protect coastal resources in accordance with guidance for new development.

7. **Account for the social and economic needs of the people of the state; assure priority for coastal-dependent and coastal-related development over other development.** In planning and project development concerning sea-level rise, assure that the social and economic needs of the people of the state are accounted for in accordance with Coastal Act Section 30001.5 (b), with special consideration for working persons employed within the coastal zone (Coastal Act Section 30001 (d)). Coastal-dependent and coastal-related development may necessarily need to be sited in areas at risk from sea-level rise, and these developments should be sited and designed to minimize risks from sea-level rise and impacts to coastal resources.

8. **Property owners should assume the risks associated with new development in hazardous areas.** LCPs and permits should require property owners to assume the risks of developing in a hazardous location (often referred to as internalizing risk), and should make it clear that property owners are responsible for modifying, relocating or removing new development if it is threatened in the future. In addition, since impacts to natural

resources result in economic and quality of life losses, any actions to minimize risks to new development should not result in encroachment onto public lands or in impacts to coastal resources. To accomplish this, an LCP can include deed restriction requirements for hazardous areas, establish hazard abatement districts, or other strategies that require that property owners take responsibility for modifying, relocating, or removing development should it become threatened by natural hazards like sea-level rise. For a new development project potentially subject to future erosion, the permit should include a "no future seawall" deed restriction that requires property owners to waive the right to any future shoreline protection.

C. MAXIMIZE PROTECTION OF PUBLIC ACCESS, RECREATION, AND SENSITIVE COASTAL RESOURCES [Coastal Act Chapter 3; Section 30235]

9. **Provide for maximum protection of public beach and recreational resources in all coastal hazard planning and regulatory decisions.** The Coastal Act requires the provision and protection of maximum public access and recreation, consistent with Section 30252. In all planning and regulatory efforts, identify potential impacts from sea-level rise to public access and recreation opportunities, and develop and carry out a plan to mitigate impacts. Some options to maximize and enhance public access and recreation in light of sea-level rise include establishing new public access areas, elevating or moving trails inland when threatened by sea level, developing or modifying beach management plans to accommodate changes in sea level, or removing barriers that contribute to the loss of beach and recreation areas.

10. **Maximize natural shoreline values and processes; avoid the perpetuation of shoreline armoring.** If existing development (both private and public) is threatened by sea-level rise hazards, it should employ the least environmentally damaging feasible alternatives and minimize hard shoreline protection. Priority should be given to options that enhance and maximize coastal resources and access, including innovative nature-based approaches such as living shoreline techniques or managed/planned retreat. In some situations, protection of existing structures may include the use of traditional hard shoreline protection devices (as permitted by the Coastal Act under certain conditions). If shoreline protection is necessary and allowable under the Coastal Act, use the least-environmentally damaging alternative, incorporate projections of sea-level rise into the design of protection, and limit the time-period of approval, for example, to the life of the structure the device is protecting. Major renovations, redevelopment, or other new development should not rely upon existing shore protective devices for site stability or hazard protection. Where feasible, existing shoreline protection that is no longer needed should be phased out.

11. **Address other potential coastal resource impacts (wetlands, habitat, scenic, etc.) from hazard minimization decisions, consistent with the Coastal Act.** Actions to address sea-level rise in LCPs or permits should not exacerbate other climate-related vulnerabilities or undermine conservation goals and broader ecosystem sustainability. For example, siting and design of new development should not only avoid sea-level rise

hazards, but also ensure that the development does not have unintended adverse consequences that impact sensitive habitats or species in the area.

12. **Address the cumulative impacts and regional contexts of planning and permitting decisions.** Sea-level rise will have impacts at both the site-specific and regional scales. In addition to the evaluation of site-specific sea-level rise impacts, LCPs and projects should evaluate the broader region-wide impacts, in two different contexts. First, the LCP or project should evaluate how sea-level rise impacts throughout an entire littoral cell or watershed could affect the LCP jurisdiction or project. Second, LCPs and projects should evaluate how options to adapt to sea-level rise could result in cumulative impacts to other areas in the littoral cell or watershed, and should take actions to minimize any impacts. While some smaller scale projects may focus on the impacts to a single site, it is crucial to consider regional impacts and any cumulative impacts within a larger planning context in a LCP or other larger-scale analysis. These larger-scale impacts are best addressed in an LCP but may also need to be addressed at a project level within a CDP.

13. **Require mitigation of unavoidable public coastal resource impacts related to permitting and shoreline management decisions.** For unavoidable public resource impacts, require mitigation of resource impacts over the life of the structure as a condition of approval for the development permit. For example, for any wetlands or other sensitive habitat lost due to new development, require the landowner to conserve or restore wetland habitat. For sand supply or public recreation impacts due to armoring and the loss of sandy beach from erosion in front of shoreline protection devices, require a sand mitigation fee or other necessary mitigation fees or provide other commensurate in-kind mitigations.

14. **Include best available information on resource valuation in mitigation of coastal resource impacts.** Planning and project development should evaluate the societal and ecosystem service benefits of coastal resources at risk from sea-level rise or actions to prepare for sea-level rise. These benefits can include flood protection, carbon sequestration, water purification, tourism and recreation opportunities, and community character. Resource values can be quantified through restoration costs or various economic valuation models. Mitigation of resource impacts should include the best available information from research on and analytic tools for resource valuation.

D. MAXIMIZE AGENCY COORDINATION AND PUBLIC PARTICIPATION [Coastal Act Chapter 5; Sections 30006; 30320; 30339; 30500; 30503; 30711]

15. **Coordinate planning and regulatory decision making with other appropriate state, local, and federal agencies; support research and monitoring efforts.** Given the multitude of sea-level rise planning, research, and guidance efforts occurring in California, it is critical for agencies and organizations to share information, coordinate efforts, and collaborate where feasible to leverage existing work efforts and improve consistency. The Commission and Commission staff will continue to share information, coordinate its sea-level rise efforts with other relevant agencies and organizations,

support research and monitoring efforts, and also encourage local jurisdictions to both coordinate efforts regionally, and engage relevant stakeholders in the scoping, design, and implementation of adaptation actions. The Commission will also strive to provide the necessary training for Commissioners and Commission staff, and to support local governments, applicants, tribal groups, and other interested parties in the update of LCPs to address sea-level rise. Finally, it is critical that the Commission seek ongoing financial support for these efforts.

16. **Consider conducting vulnerability assessments and adaptation planning at the regional level**. Where feasible, local governments should coordinate vulnerability assessments and adaptation planning with other regional jurisdictions that face common threats from sea-level rise. A regional vulnerability assessment provides an opportunity to evaluate impacts that span multiple jurisdictions, assess and implement regional adaptation strategies, coordinate responses, and leverage research and planning funds. Regional planning is a crucial element to minimizing impacts to infrastructure and natural resources that span multiple jurisdiction boundaries.

17. **Provide for maximum public participation in planning and regulatory processes.** The Coastal Commission and Commission staff will continue to provide avenues for maximum public participation in planning and regulatory processes, and will continue to establish and/or expand non-traditional alliances (e.g. between/among public and private resource managers, tribal groups, scientists, decision-makers), share knowledge openly and actively, and regularly and clearly communicate to the public on the science as well as on a range of solutions to prepare for sea-level rise.